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ENTERPRISE BUDGETS: A TOOL FOR VERTEBRATE PEST CONTROL DECISION MAKING IN DEVELOPING COUNTRIES

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ABSTRACT: Semi-subsistence farms that predominate in developing countries have more complex goals than the strict profit motives of corporate farms. Small farm management decisions are commonly based on a desire to increase production while avoiding risks and reducing labor demands and operating costs. Enterprise budgets are a valuable tool for understanding diverse farming systems and farmers' decision-making processes. The preparation of enterprise budgets documents production expenses, labor requirements, and specific activities related to pest control, as well as sources of supplies and technical information. By identifying what resources are commonly used and the relative importance of farm labor, the preparation of enterprise budgets facilitates the development of appropriate rodent control techniques and effective extension programs.

INTRODUCTION

Most developing countries face soaring demands for agricultural products to generate foreign exchange and to feed rapidly growing populations. Effective pest control is essential to meet this demand whether production is increased by cultivation of new areas, or by making existing acreage more productive (Brader 1979).

At one end of the farming spectrum are commercial, corporate, or cooperative farms with paid management. Purely subsistence farms, with limited commercial contact, lie at the opposite end of the spectrum. In most developed countries farms are predominantly commercial enterprises, dominated by profit motives. As with other parts of the industrial sector, these farmers have access to production credit and highly organized market systems. They receive technical assistance through a variety of publications or cooperative extension programs. The private sector also assists them by promoting innovations that make farms more efficient and more profitable.

Most farms in lessor-developed countries (LDCs) fall between the extremes of being strictly commercial or purely subsistence oriented (Harwood 1979). Farmers rely on their crops primarily to feed their families, with surplus production sold. Cash crops, grown on a portion of their land, play an important role supplementing the family's income. These farmers typically have little or no available capital to invest and rarely have access to credit. Technical assistance may be entirely unavailable or it may not be directed at their particular needs.

Farming in LDCs is inherently risky. Consequently, decisions are made based on a desire to increase production while avoiding risks, and reducing labor demands and operating costs. Unstable prices and difficulties marketing surplus production make the income of semi-subsistence farmers extremely unstable. For this reason farmers commonly grow less-profitable subsistence crops and allot only a portion of their land and labor to cash crops. Alternative sources of nonfarm employment are rare, thus farming decisions are critical for survival.

The development of a national rodent control program commonly focuses on restructuring government agencies and promoting a single control strategy which has been shown to be cost-effective. Integration of semi-subsistence farmers into crop protection programs of this type has had mixed success; pest control techniques, well suited for larger, profit-oriented farms, are often inappropriate for smaller farms with little or no experience applying pesticides (Whyte and Boynton 1983).

Cost-benefit analysis, which measures the profitability of a particular production input, does not reflect how appropriate a particular intervention is for any given farming system. I propose that enterprise analysis should be conducted, in conjunction with cost-benefit studies, to better understand the farming practices of distinct socio-economic groups in order to select rodent control techniques appropriate for their particular economic and labor constraints.

PARTIAL BUDGETING: A COST/BENEFIT ANALYSIS

Cost-benefit studies are a form of marginal analysis based on partial budgets, the simplest form of budgetary analysis (Brown 1979). These studies are used to estimate the profitability of relatively minor changes, calculating the increase or decrease in net farm profits that result from a proposed modification (Ibid.). Rodent control studies commonly compare the economics of alternative control strategies or cite cost/benefit figures (Fiedler et al. 1982, Reidinger and Libay 1980, Salmon and Schmidt 1984, Smith 1967, Wood 1969). Bait costs alone may be compared (Wood 1969) or net profits may be calculated without including labor costs, assuming 100% loss reduction (Smith 1967). A positive economic return or a low cost may be all that supports the recommendation of a particular control technique in a developing country.

For a new farming practice to be adopted, it must be technically feasible as well as economical. Partial budgets compare total cost (new costs and foregone revenues) to benefits (costs saved and new revenue) of a particular intervention to determine the economical advantage of adopting a new idea. No

indication of technical feasibility can be determined because an intervention's feasibility is assumed as an essential precondition in partial budget analysis (Brown 1979). However, farmers may not have access to required inputs or the available capital to purchase them. It must also be assumed that the farm's management is capable of introducing the change without putting stress on the existing organization (Ibid.).

ENTERPRISE BUDGETS

Enterprise budgets detail production costs, materials, labor, and yields for each subdivision of a farm over a particular time period. A subdivision can be any individual crop or livestock operation. Mixed farming systems common in developing countries can be analyzed as a single enterprise because the associated crops are interdependent. Enterprise budgets measure overall farm income and profits on a per-crop basis. This allows comparison of different enterprises on a farm or on similar farms since the analysis is on a per-area basis.

The reliability of an enterprise budget and the conclusions drawn from it depend on how the information was gathered. Some farms keep detailed accounts and production records, but this is rarely the case on small farms where labor is supplied by a farmer and his family and cash expenditures are minimized. If the farmer has a production loan, bank records can often be used as a source of information on the quantity and value of inputs and production. A less reliable method is based on farmer recall at the end of a production period. For the best data, farmers should be regularly observed throughout their cropping cycle.

In the comparison of farm incomes and profits it is important to separate labor costs from material costs. Enterprise budgets calculate a farm's labor costs based on current market values, regardless of whether the labor is supplied by family members or by hired labor. A farm's net profit, the difference between gross revenue and total costs, is the return to management and capital similar to any corporate profit. Overall farm income, the sum of labor costs provided by the family and the farm's net profit, is an important consideration in developing countries where alternative sources of employment are scarce. Family income is important for understanding semi-subsistence farming, because it explains how much families are compensated for their labor when labor intensive crops with little or no net profit are grown.

Enterprise budgets are a valuable tool for understanding farming systems and the decision making process because they identify production expenses, labor requirements, and specific activities related to pest control, as well as sources of supplies and technical information. These budgets do not indicate all the resources available to a farmer. However, they do document what is commonly used and they indicate the relative importance of family labor, wage labor, and purchased inputs.

COMORO ISLANDS RODENT CONTROL PROJECT

The Comoro Islands is a small nation consisting of three islands, located in the Indian Ocean equidistant between Mozambique and the north end of Madagascar. The United Nations has identified the country as one of the world's 31 poorest nations.

In April 1980, the World Bank established a project (World Bank Project No. 1035-COM) in the Comoro Islands to increase coconut and copra production of small-scale farmers (World Bank 1980). Productivity of existing plantations was to be increased by controlling roof rat (*Rattus rattus*) damage, estimated at 37% of total production (De Lorme 1971), and introduction of high-yielding new varieties. Annual losses of approximately US\$ 1.3 million represented more than 1% of the country's Gross Domestic Product, or an average of 17 coconuts per tree.

The World Bank project on which I worked differed considerably from previous rodent control efforts in the Comores. The government's responsibility was to develop effective methods and make bait readily available to farmers. For the first time farmers were required to pay a portion of bait costs and apply it themselves. Reducing government expenditures was essential for continuing the project as long as possible. The farmers contributed 75% of the total cost of rodent control, 17% for bait and 58% for labor, which farmers could supply themselves.

The development of this project relied heavily on previous rodent control research conducted by the Denver Wildlife Research Center and the Rodent Research Center in the Philippines. However, Comorian farming practices required modification of monthly crown baiting recommended in the Philippines (Rodent Research Center 1976). In coconut plantations placement of 150-gram anticoagulant ground-corn baits, sealed in small plastic sacks, was recommended in 20% of the tree crowns at regular 2-month intervals. In conjunction with the application of toxicants, farmers were instructed to maintain their fields as weed-free as possible. Similar to results from the Rodent Research Center (1976), crown baiting proved to be more successful at reducing damage than ground baiting and safer, since bait was inaccessible to animals and children. Two-month intervals successfully reduced rat damage to almost zero after three successive applications (Evans 1984b). A slight degree of reinfestation, which occurred between each application, was controlled by the next application. Even though monthly applications were recommended in the Philippines (Rodent Research Center 1976), Comorian farmers would not adopt such a rigorous schedule. Organizational constraints also prevented the project from supplying farmers with bait at regular monthly intervals. Therefore, 2-month periods were recommended between applications and a slight degree of reinfestation was tolerated.

Enterprise budget analysis in the Comoro Islands detailed the financial burden and labor requirements of rodent control in perspective with other operating costs and labor demands for coconut production. My analysis revealed major differences between islands in operating costs, farm family income, and net profits (Table 1).

Table 1. Enterprise budget: coconut and copra production in the Comoro Islands. All prices are in U.S. dollars per hectare and the data are based on the average of 3 farms from each island. One U.S. dollar equals 350 Comorian francs.

Operating costs	Island	
	Anjouan	Moheli
Anticoagulant rat poison	\$ 5.71	\$ 1.71
machetes	4.19	1.79
sacks	0	0.09
kiln	0	0.19
wheelbarrow	0	0.16
nuts paid to laborers	23.85	7.27
depreciation	0	0.17
<u>Cultivation practices</u>		
application of rat poison	12.31	0
clean field and tree crowns	40.82	11.63
guardian	9.52	7.14
harvest costs and nut collection	28.97	26.00
dehusk nuts	6.34	5.69
tax or land rent	8.63	0.71
Total operating costs	\$ 140.34	\$ 62.55
Average production (coconuts/hectare)	(4,833)	(3,510)
cost per coconut	\$ 0.029	\$ 0.018
copra preparation costs	0	6.33
transport	2.86	0
Total costs to market	\$ 143.20	\$ 68.88
Revenue	\$ 211.43 ¹	\$ 64.44 ²
Home consumption	29.00 ³	7.54 ⁴
Gross revenue	240.43	71.98
Net profit	\$ 97.23	\$ 3.10
Net farm income	\$ 185.67	\$ 46.42

1) 4,253 fresh nuts sold at \$.0498 each.

2) 3,220 nuts divided by 6 nuts per kilo of copra = 537 kg
537 kg of copra sold at \$.12/kg.

3) value of 580 nuts at \$.05 each.

4) value of 290 nuts at \$.026 each.

In the Comoro Islands the recommended rodent control procedures would cost, for labor and bait, about US\$ 15.88 per hectare per year on the island of Anjouan (Evans 1984b). This amounts to approximately 13% of total operating costs; but of the \$15.88 increase, 77% was the value of the labor which the farmer could often supply himself. Actual cash costs represented only a 3% increase in operating costs, or an increase of 16% in cash expenditures, a sum Comorians, at least on the island of Anjouan, felt was reasonable.

On Anjouan, where all coconuts are consumed locally, net profitability from coconut production was estimated at US\$ 97.23/hectare which was comparable to principal cash crops (Evans 1984b). Conversely, on the island of Moheli, where coconut production was much greater than local demand and coconuts had to

be dried to export as copra, net profits averaged US \$3.10/hectare. For the profitability to be approximately equal on both islands, the price of copra would have to increase roughly 250%.

Comparing actual farm incomes from coconut production on the two islands highlights another striking difference. The value of labor put into coconut production on Anjouan was \$88.44/hectare, more than double the \$43.32/hectare of Moheli. If all the labor was supplied by the family, the resulting net family income (net profits plus the value of family labor) would be \$185/hectare on Anjouan compared to only \$46/hectare on Moheli. Yet average farm sizes for Anjouan and Moheli are, respectively, 0.5 hectares and 3.0 hectares, so actual farm incomes from coconut production alone are \$92.50 and \$138.88.

The disparity between farm income on the two islands shows how economic conditions affect a farmer's decisions. On Anjouan farmers are at near-subsistence levels due to their small farm sizes. Their goals must be the assurance of a certain minimum production to meet immediate needs (Harwood 1979) so they concentrate on a staple crop like coconut. Rat control allows these farmers to increase production with little additional expense and any production beyond a family's basic needs has a readily available local market.

Ironically, my analysis shows that farmers on Moheli may be less interested in maximizing coconut production because of their relative prosperity. Their coconut production far surpasses subsistence needs and the surplus provides a fairly good income. Assured of a degree of stability, farmers are willing to accept greater risk. Consequently, their efforts are concentrated on cash crops with highly variable yields and volatile prices, but with potentially much greater earnings. Increasing copra production, which is labor intensive, would reduce labor for more lucrative crops.

Long-term effects of the project will depend upon local price trends for fresh nuts and copra, availability of foreign markets, and continued government support. After 2 years of extension activities, each island had implemented rodent control to differing degrees, due primarily to each island's distinct coconut-use patterns. Successfully reducing rodent damage will facilitate introduction of improved, high-yielding varieties and insure a continued supply for export and local consumption, especially on Anjouan where food shortages are critical.

CONCLUSION

As per-capita food production declines in many developing countries, more attention is focused on prevention of the staggering food losses caused by vertebrate pests (Bullard and Shuyler 1983). Optimum pest control strategies vary with farming systems and are determined by available resources. Preparation of enterprise budgets facilitates the development of appropriate rodent control techniques and effective extension programs by providing an in-depth analysis of farmers' economic resources, technical experience, and labor constraints, as well as their access to extension personnel.

Enterprise budgets will not provide direct answers as to how much a farmer will spend to control a particular pest. However, they will indicate the level of cash expenditures, the use of farm inputs and labor demands for other farm practices related to the production of a crop. Existing constraints, such as a lack of money to purchase inputs or an inadequate infrastructure that fails to provide materials, can also be identified.

Enterprise budgets are a specific tool to help quantify farm characteristics and identify production constraints through the comparison of different areas and socio-economic groups. Analysis of enterprise budgets is one way to better understand how a small-scale farmer varies his farming system to satisfy his diverse goals related to increasing production while reducing labor and minimizing risk, all on an extremely limited budget.

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